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WAVEGUIDE Y-CIRCULATOR,(U)
MAR 82 A A SHIMKO, V N SHAKHGEDANOV
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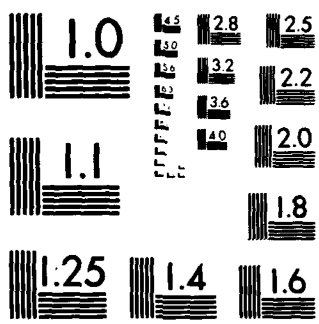

MICROCOPY RESOLUTION TEST CHART

FTD-ID(RS)T-0167-82

FOREIGN TECHNOLOGY DIVISION

AIR FORCE SYSTEMS COMMAND

WAVEGUIDE Y-CIRCULATOR

by

A.A. Shimko, V.N. Shakhgedanov, et al

FOREIGN TECHNOLOGY DIVISION

EDITED TRANSLATION

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WAVEGUIDE Y-CIRCULATOR

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

Waveguide Y-Circulator

A. A. Shimko, V. N. Shakhgedanov, A. K. Stolyarov, V. I. Vol'man

In certain Y-circulators for expansion of the frequency band and reduction of the KSV (swr - standing wave ratio) within the limits of this band dielectric bushings of different types and shapes are employed, which are located near a ferrite element and have an axis of symmetry, coinciding with the axis of symmetry of a hybrid circuit (waveguide Y-joint). For increasing the thermostability of the circulator thermostable ferrites are employed or the circulator is temperatured controlled, and sometimes the entire amplifier also. However, the reduction of the KSV (swr) of the circulator in the working frequency band is insignificant and it is not possible to attain a "smooth" characteristic. Although the thermostatic control (temperature control) of the circulator improves the thermostability of the circulator, it also considerably increases the overall dimensions, the weight of the device and the energy consumption.

For expansion of the frequency band, reduction of the KSV (swr) and increasing the thermostability in the center of the hybrid circuit (waveguide Y-joint) of the proposed circulator one or several metal cylinders, forming together with the ferrite a low-Q-factor resonator for a wave of the TM_{110} type, are positioned axially to the ferrite element.

Fig. 1 depicts the proposed circulator with one cylinder in two projections; Fig. 2 depicts the same with two cylinders.

In the center of the symmetrical waveguide Y-joint (hybrid circuit) 1 is located the ferrite element 2, magnetized perpendicu...r to the broad wall of the waveguide, surrounded (the ferrite element) by one or several metal cylinders 3, positioned symmetrically relative to the axis of the Y-joint (hybrid circuit) on the broad walls of the waveguide. The ferrite element together with the metal cylinders forms a low-Q-factor resonator, tuned to the first harmonic of the electric field (a resonator for a wave of the TM_{110} type). This component of the field is amplified and creates favorable conditions for the excitation of electromagnetic energy in the open leg of the circulator. The matching of the input and the output channels of the circulator is improved, and this means the KSV (swr) is reduced and the decouplings are increased. Since the resonator id low-Q-factor, then the working band of the circulator is rather broad, which was confirmed experimentally.

The proposed Y-circulators, which operate in the three-centimeter range, have decouplings higher than 25 dB, losses of less than 0.5 dB and a KSV (swr) of less than 1.1 in a frequency band up to 1,000 MHz. These parameters even with the employment of ordinary ferrite are preserved in a band of the order of 600 MHz with a variation in the ambient temperature of from -10 to +50°C. The design of this type of circulator is simple to manufacture and to tune and ensures identical parameters in series manufacturing.

Patent Claims

The waveguide Y-circulator, which contains a magnetized ferrite element, located in the center of the H-plane branching, which is distinguished by the fact, that for the purpose of increasing the frequency band and reducing the standing-wave ratio over a broad range of temperatures, one or several metal cylinders, which form together with it a low-Q-factor resonator of the first harmonic of the electrical field, are positioned axially with the mentioned ferrite element.

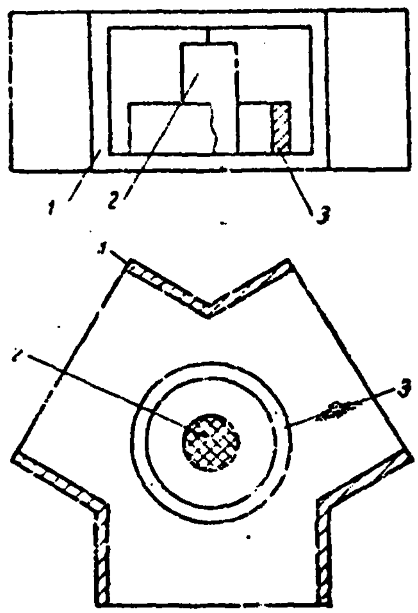

Fig. 1

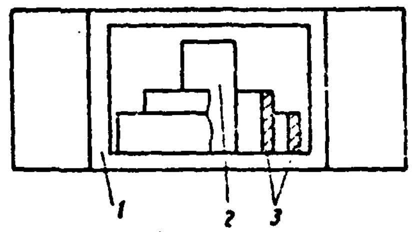

Fig. 2

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